

ask the expert...

SKIM DAM DESIGN AND PERFORMANCE – A KEY CONSIDERATION IN INGOT CASTING



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The use of skim dams is an essential element in optimizing aluminium ingot casting operations to provide improved process performance and metal quality. Pyrotek's Global Product Manager for this area of production technology, Tabb Williams*, explains the features and process benefits of skim dams, and responds to a range of practical questions posed by customers.

Q: What are skim dams and how do they improve my process features?

A: The primary function of skim dams in casting aluminium alloys is to hold back oxide in the ingot head within the dam. The skim dam retains the floating surface oxide, preventing it from "rolling over" onto the ingot face or ends, which can often result in cracking. 5XXX series alloys, with over 1% magnesium, usually require a skim dam, because these materials have a tendency to generate more oxide or skin, and the severity of the oxide is directly related to the Mg content. Skim dams are generally employed in electromagnetic casting (EMC) and direct chill casting (DC). For EMC, skim dams are even more important, since there is no mould wall contact to act as a dam. A skim dam can also be used in conjunction with the combo bag to further improve metal quality.

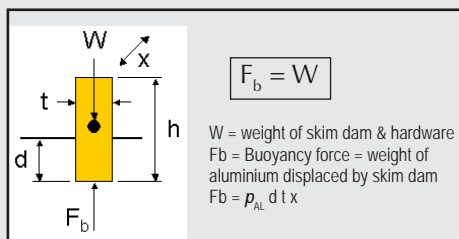
When it is properly positioned, the skim dam is a very effective tool to retain

any dross or oxide generated from the metal transfer between the spout and the combo bag. Also, a well-positioned skim dam will also marginally slow down and spread the metal flow.

Q: What are the different types of skim dams available?

A: The skim dam is usually a machined piece of refractory board, typically N-14, N-17 or B-3 material, or it could also be a cast refractory part such as RFM®, which surrounds the combo bag. The usual form of the dam is an elongated ring, generally rectangular in geometry and positioned to surround the outside of the combo or channel bag. Skim dams can be fixed, mounted on the mould, or they can be "floating." The most common type of skim dam is the floating type, which is typically suspended from the casting distribution trough by small chains or wires. The depth of penetration into the molten metal for a floating dam is governed by the buoyancy equation:

$$F_b = W$$



W = Weight of skim dam & hardware
F_b = Buoyancy force
 = weight of aluminium displaced by skim dam

$$F_b = r_{AL} d t x$$

$$W = r_{REF} h t x \text{ (does not include hardware)}$$

r_{AL} – density of aluminium

r_{REF} – density of skim dam refractory material

Q: What is special about the design and configuration of Pyrotek skim dams?

A: Skim dams are produced to specific requirements of particular processes and each dam design is proprietary to individual Pyrotek customers. The configuration is defined by the top view geometry and the cross-sectional shape. Although generally rectangular in geometry, many dams have radius corners or ends and some have an arc on the faces.

The design and shape of the skim dam is also determined essentially by the mould geometry, metal flow and the type of alloy cast. The geometry is also dependent on mould size; larger moulds typically employ larger dams.

Skim dams also have to be sized so that they do not interfere with the float or level sensor. The cross-sectional shape of a skim dam is also important. These shapes can be rectangular or have a tapering side. The shape chosen is also governed by the material selection.

Q: What material options are available for skim dams?

A: Pyrotek offers a wide selection of materials for skim dams. The range of calcium silicate boards (N-17, N-14, B-3, and B-3A) from which the dams are fabricated offer the flexibility of easy machining to meet customers' specifications. Skim dams can also be fabricated using a castable refractory, and Pyrotek also has a wide range of these materials from which to choose. The premiere material for Pyrotek skim dams is RFM—a unique, high-strength

ask the expert... (continued) by Tabb Williams**SKIM DAM DESIGN AND PERFORMANCE—A KEY CONSIDERATION IN INGOT CASTING**

composite material that allows for designs with complex geometry and relatively thin cross-sections. A skim dam made from RFM can have a “knife edge” cross-section that will keep oxide from “rolling under” the dam. Employing the RFM skim dam, which sinks a little bit deeper into the molten metal, has been shown to improve oxide patch collection as a result of the razor effect. RFM has a high modulus of rupture—it is a very tough material, so the incidence of breakage is very low.

Q: What are the actual benefits of using Pyrotek skim dams with my particular casting installation?

A: RFM skim dams deliver a range of key advantages and process benefits in conjunction with casting process equipment.

They require no pre-heating and have excellent mechanical properties — they are light and strong and have superior erosion resistance. They sink deeper in molten aluminium; they are not-wetted and have improved retention of oxides. They can be moulded and repaired, and offer optimum high temperature service.

For more information, please contact your local Pyrotek sales engineer.

www.pyrotek.info/ingot

** Tabb Williams, Sales Engineer, Pyrotek Aluminium Division, Salisbury, North Carolina, USA, is a Pyrotek expert in ingot casting with over 20 years experience in the field. He holds a bachelor of science degree in mechanical engineering. Prior to joining Pyrotek, Tabb was the plant engineer at the Reynolds Metals Company's casting R&D Center. He is a specialist in casting tooling and launder design and uses his expertise in supporting customers' specific needs.*



RFM skim dam in operation